FST Meeting Oct 14-15,2004 - RGS

Some RGS “program” Highlights

Modeling Progress

Synchrotron Efficiency tests

Configuration Studies at CDF and IMDC-
well-defined, well-documented RGS OPG

Technology development highlights will be given by individual teams

Grating Trade Study

General Approach:

- Develop an independent model of off-plane gratings
- Assess confidence that gratings can be made to meet model expectations, and estimate fidelity of modeled performance
- Compare in-plane and off-plane modeled performance
- Examine systems engineering issues
- Assessment, evaluation and recommendation

Significant Progress has been made:

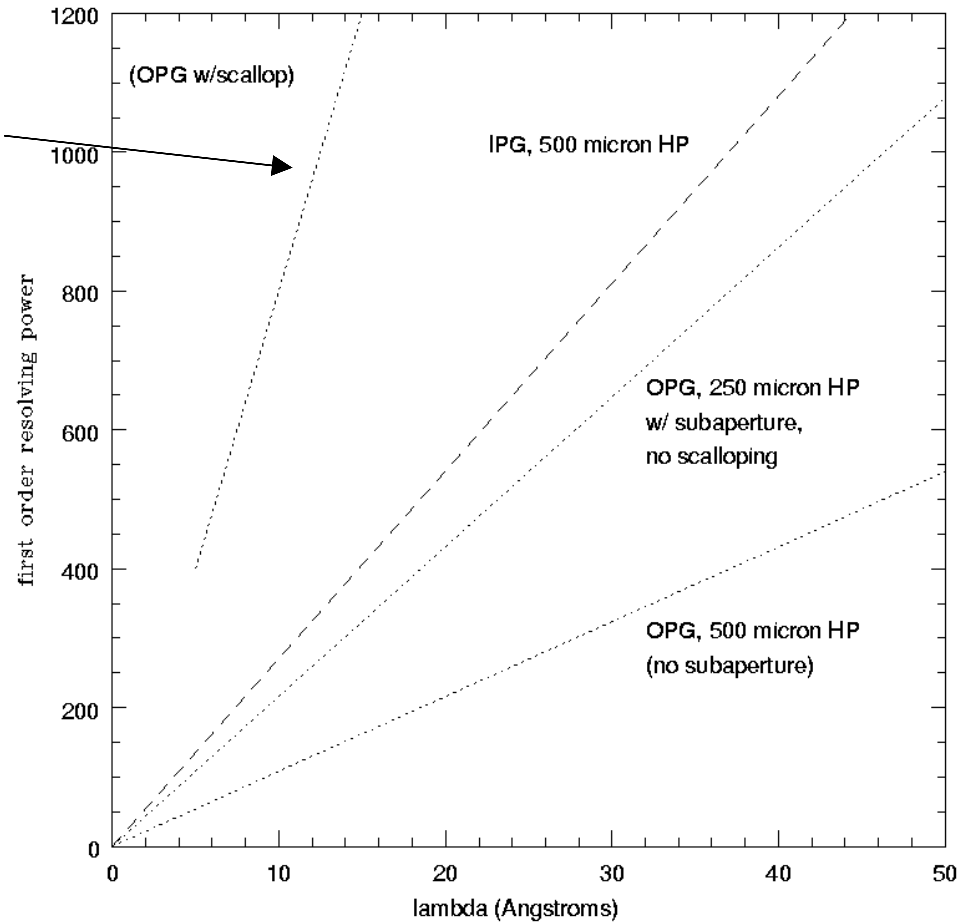
- Modeling of spectral resolution reported at SPIE June ‘04
  Plan to report next FST meeting
- Synchrotron tests give a handle on estimating realistic grating efficiencies, constrain polarization effects (reported today by Martin Laming)

Speakers

Chih-Hao Chang and Mireille Akilian	Advances in X-ray Reflection Grating Technology	20 min
W. Cash	Status of Off-plane gratings	10 min
J. Martin Laming	Progress on off-plane gratings calibration at Brookhaven NSLS	10 min

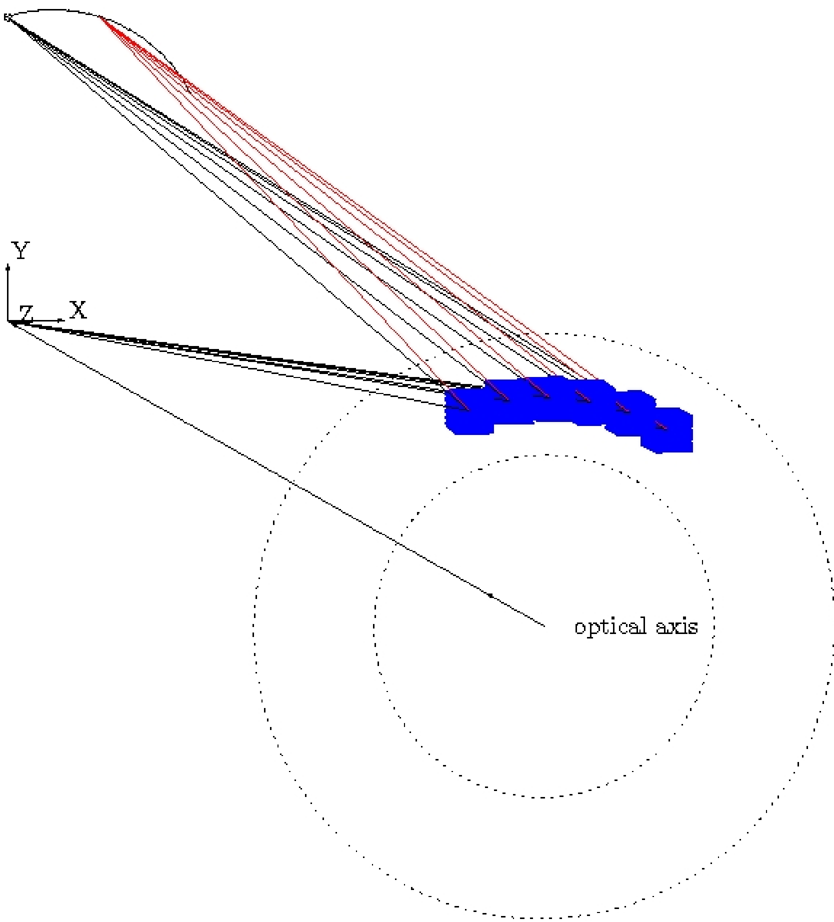
Predicted OPG performance in various configurations (approx)

We raytrace this



Raytrace assumptions and layout

- Used S-Lang+ISIS (see http://www.s-lang.org and http://space.mit.edu/CXC/isis/) ISIS is scriptable in S-Lang - whole raytrace was ***less than 1000 lines of code!***
- SXT focus defines origin
- Reference grating at (0,600,8988)
- Period=1724A (1/d=5800l/mm), α=30, angle of incidence 2.545 deg with radial grooves*
- Reference module contains 10 **identical gratings** fanned and oriented to overlap 0th order at (0, 799.8, -17.79), and to force the dispersion arcs to coincide at the top. Reference grating is at (0,600,8988)
- 7 **identical modules** arrayed **in plane** 600mm from optical axis, along TOP
- Modules oriented to overlap 0th order (this fixes the normal), and pivoted to define dispersion curve



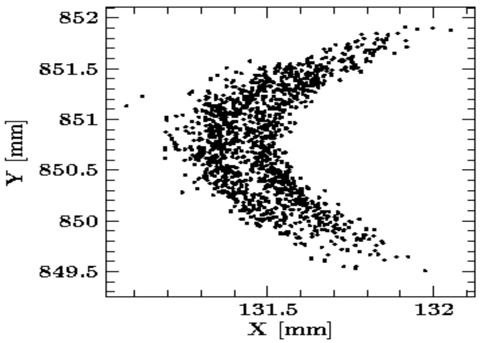
Note path length differences!

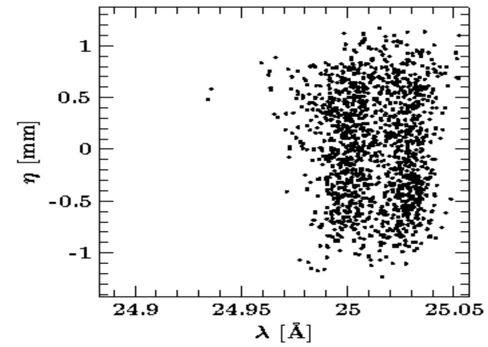
Pipeline process: from detector coordinates to spectrum

Two λ's separated
by 0.028 A (see McEntaffer 2003)

25A, real optic, 100x100mm, top

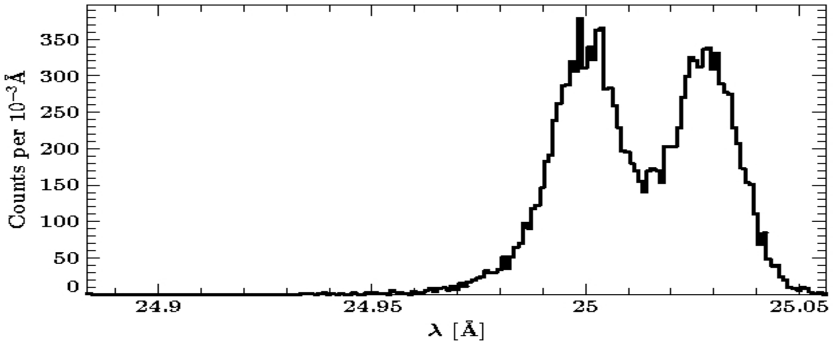
Detector coords



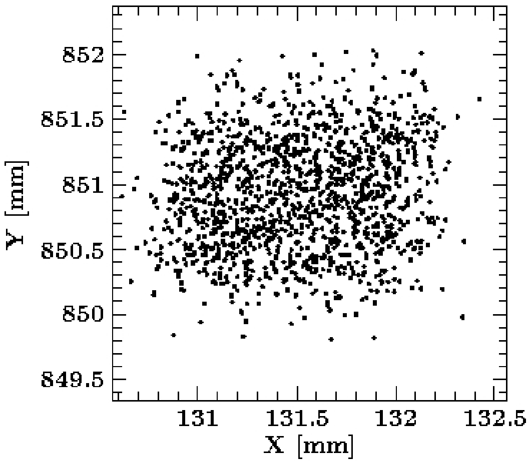


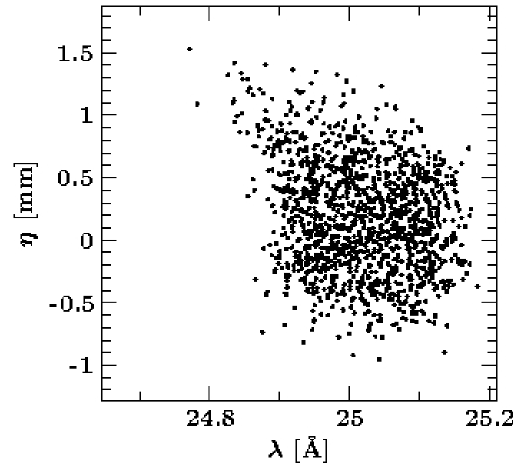
Dispersion coords

dispersion Histogram (spectrum)

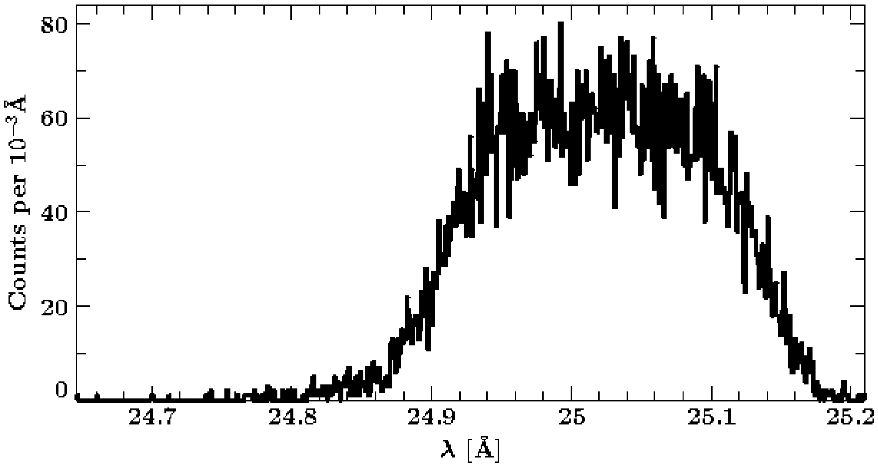


25A, real optic, 100x100mm,bottom

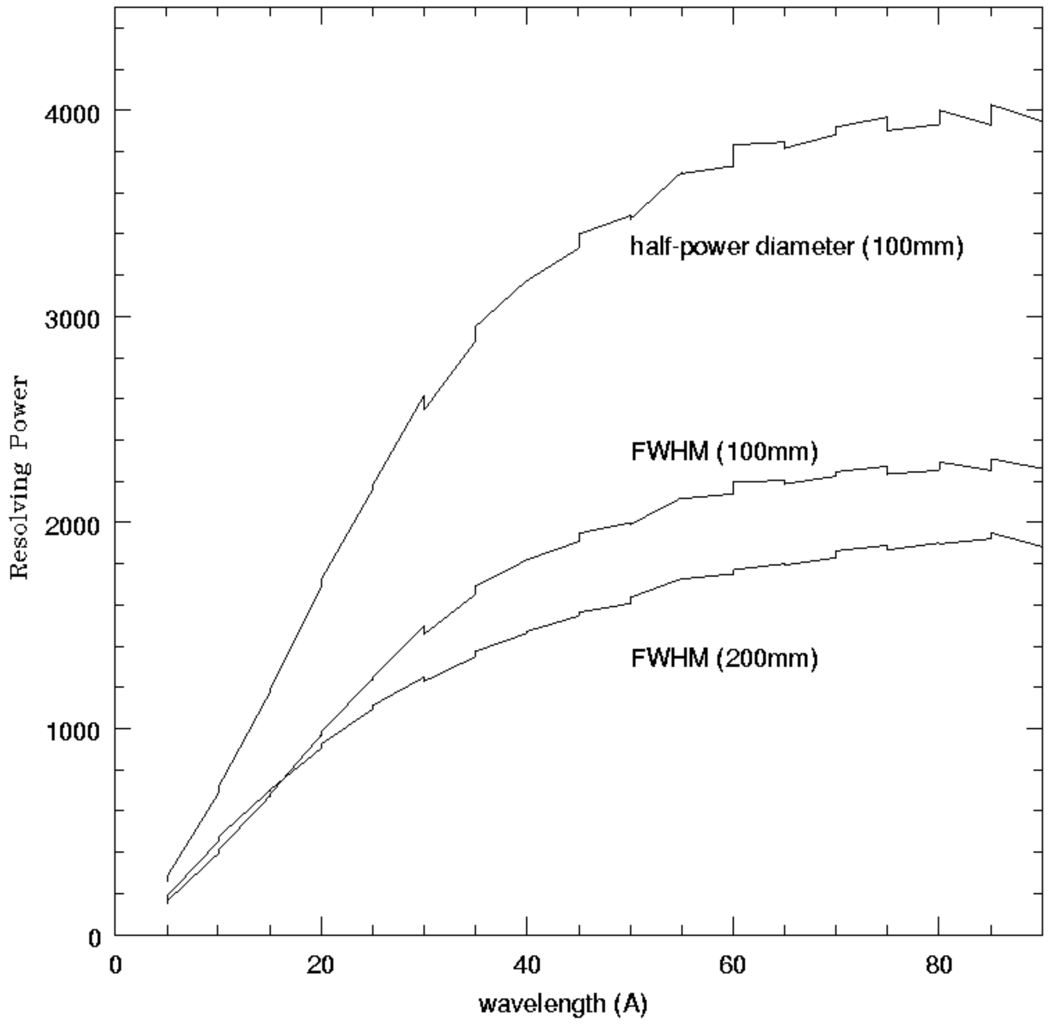




Modules at bottom of SXT show VERY degraded resolution in this arrangement

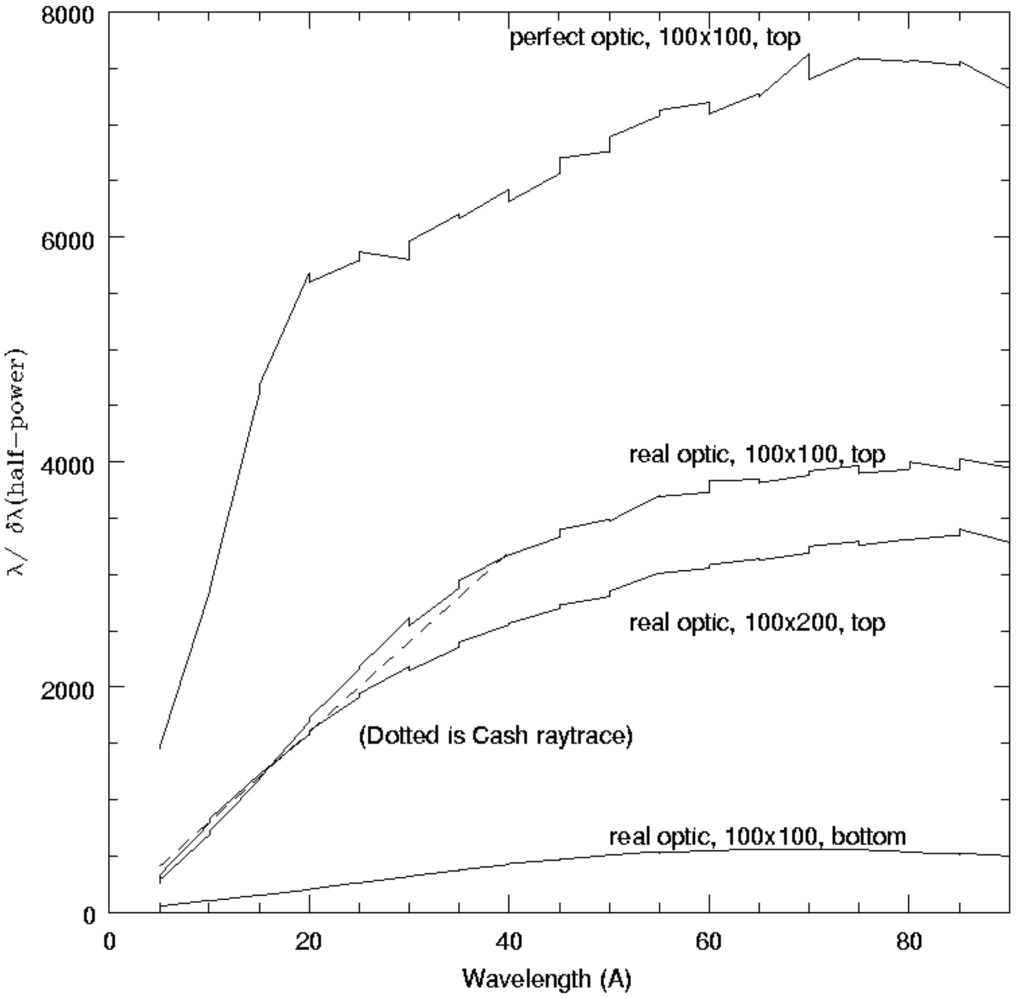


Resolving power



Assumption of FWHM or half-power diameter to define "resolution" makes a big difference

Impact of optic quality, grating size and placement



Note excellent agreement with Web's prediction-provided no gratings at the bottom of the SXT are included

Discussion + Conclusions

- Resolving powers over 1000 appear to be achievable (λ > 12 A); (for shorter wavelengths, higher orders needed)
- Separate accommodation must be made for gratings at the bottom of the SXT (separate readout, curved gratings, modified optic, other?)
- Cross-comparison with other raytraces (Gallagher, Huang, Rasmussen) (Andy has input our suggested arrangement into his model and confirms these spectral resolutions are achieveable.)
- Raytrace for full array of modules remains to be done, with realistic effective areas
- Pipeline processing (extracting dispersion coordinates) is not straightforward
- Must consider additional background